scribed hyperemia of the kidney with swelling of the tubules, and found albuminous casts and blood cells in the tubules. Swingle[5] found albumin in the urine of animals showing marked symptoms of adrenal insufficiency and reported congestion and hemorrhage in the kidneys. Hartman, *et al.*,[6] reported an accumulation of large quantities of lipoid substance in the *tubuli contorti* of the kidney.

9351

The Blood Picture of the Normal Dog.

H. D. BRUNER AND G. E. WAKERLIN.

From the Department of Physiology and Pharmacology, University of Louisville School of Medicine.

Since Wintrobe, *et al.*,[1] have pointed out the relative paucity of information in the literature concerning normal blood values for the dog, we are briefly recording additional data obtained during certain experimental studies.

Adult mongrel dogs weighing from 6 to 25 kg. were used. They were housed in individual cages and fed a commercial dog food supplemented with bones. Blood was drawn from the saphenous vein at approximately the same hour of the morning and collected into heparin. The blood values determined were the red blood cell count, hemoglobin, volume of packed red cells, reticulocyte percentage, and leucocyte count. Each red cell count was the average of 2 counts from separate pipettes differing by less than 200,000 cells per cmm.* Hemoglobins were determined by the Newcomer method. The volume of packed erythrocytes was the average of readings from 2 Wintrobe hematocrit tubes.[2] Reticulocytes were recorded from a count of 1000 red cells by the wet mount technique.[3] Each leucocyte count was obtained from the average of 8 sq. mm.* Mean corpuscular volume, mean corpuscular hemoglobin, and mean cor-

5 Swingle, W. W., *Am. J. Physiol.*, 1928, **86**, 450.

6 Hartman, F. A., MacArthur, C. G., Gunn, F. D., Hartman, W. E., and MacDonald, J. J., *Am. J. Physiol.*, 1927, **81**, 244.

1 Wintrobe, M. M., Shumacker, H. B., and Schmidt, W. J., *Am. J. Physiol.*, 1935, **114**, 502.

* The hemacytometers and red and white cell pipettes were certified by the United States Bureau of Standards.

2 Wintrobe, M. M., *Am. J. Med. Sci.*, 1933, **185**, 58.

3 Wakerlin, G. E., Bruner, H. D., and Kinsman, J. M., *J. Pharm. and Exp. Therap.*, 1936, **58**, 1.

puscular hemoglobin concentration were calculated.[4] A total of 251 weekly counts was made on 34 dogs, 17 males and 17 females, during a maximum period of 11 months.

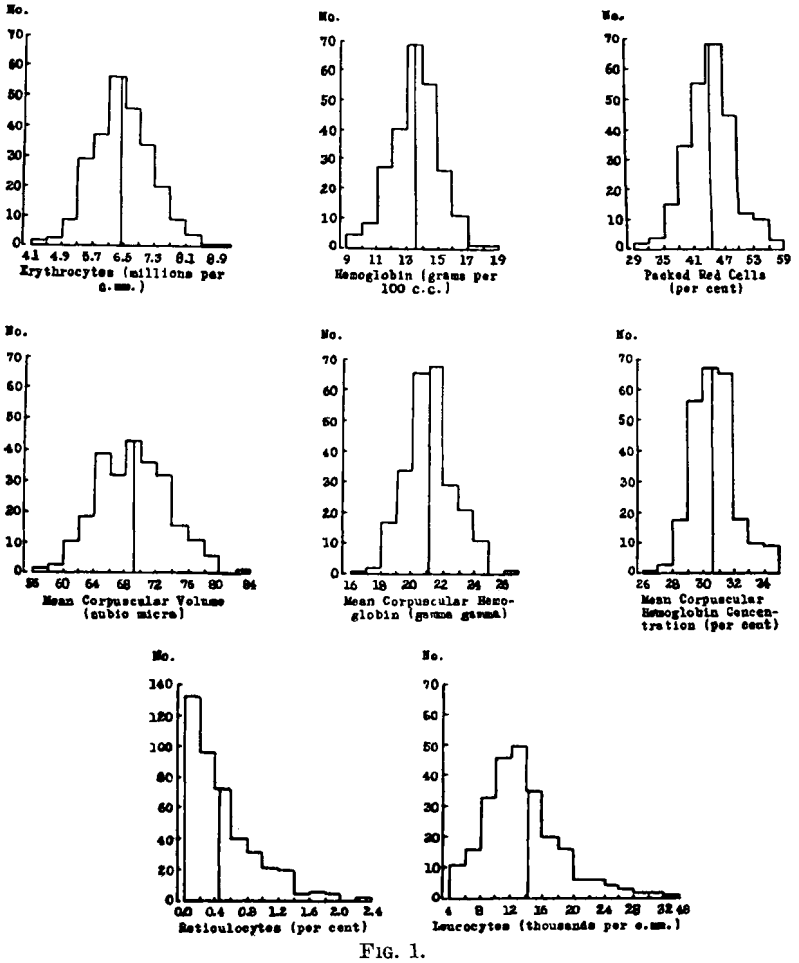

FIG. 1.
Results of 251 Blood Examinations on 34 Normal Dogs.

The results are recorded in the histograms of Fig. 1 and in the statistical analysis of the findings in Table I. We noted, as have others, that the erythrocyte count of the dog may vary as much as 1.5 millions within 7 days and that variations of 1.0 million were not unusual. These fluctuations in red cell count were accompanied by more or less corresponding changes in the hemoglobin and hematocrit values. The mean corpuscular volume, mean corpuscular

[4] Wintrobe, M. M., *J. Lab. and Clin. Med.*, 1932, **17**, 899.

TABLE I.
Statistical Analysis of 251 Blood Counts on 34 Normal Dogs.

	Mean	Standard Deviation	Coefficient of Variation (%)	Calculated Extremes		No. Observations beyond Calculated Extremes	
				Maximum	Minimum	Greater	Less
Erythrocytes (millions per cmm.)	6.45±.03	0.76±.02	11.73	8.73	4.17	1	2
Hemoglobin (gm. per 100 cc.)	13.56±.07	1.60±.05	11.84	18.36	8.76	1	0
Hematocrit (%)	44.28±.20	4.78±.14	10.79	58.62	29.94	0	0
Mean Corpuscular Volume (cubic micra)	68.9±.19	4.53±.14	6.58	82.49	55.31	1	0
Mean Corpuscular Hemoglobin (gamma gamma)	21.1±.07	1.57±.05	7.44	25.81	16.39	1	0
Mean Corpuscular Hemoglobin Concentration (%)	30.7±.06	1.40±.04	4.56	34.90	26.50	1	0
Reticulocytes (%)*	0.44±.014	0.42±.010	95.7	1.70	0.0	7	—
Leucocytes (thousands per cmm.)	14.18±.22	5.21±.16	36.75	29.81	0.0	2	—

*420 counts.

hemoglobin, and mean corpuscular hemoglobin concentration may vary as much as three times the standard deviation within 7 days. The mean reticulocyte value is comparable to that of Krumbhaar.[5] The mean value and the wide variations in the number of leucocytes compare favorably with the findings of Mayerson[6] and the compilation of Scarborough.[7] Our statistical analysis agrees closely with that of Wintrobe.[1] In agreement with previous reports for the dog,[1] we noted no significant differences between the erythrocyte count, hemoglobin, volume of packed red cells, reticulocyte percentage, and leucocyte count of the male and female dogs studied.

Summary. The results of 251 determinations of the red blood cell count, hemoglobin, volume of packed red cells, mean corpuscular volume, hemoglobin, and hemoglobin concentration, reticulocyte percentage and leucocyte count of 34 normal dogs are recorded. No significant sex differences for these values were observed.

9352 P

Study of Peripheral Circulation by Means of an Alternating Current Bridge.

HUBERT MANN.

When the electrical conductivity of any part of the body is measured by means of an alternating current bridge it is found that this conductivity shows a rhythmic variation synchronous with the pulse. This phenomenom which can be observed in any accessible part of the body, offers a method of studying the peripheral circulation. For experimental purposes a single finger, generally the right index finger, has been chosen as the subject of this investigation.

The experimental set-up is as follows: 2 strips of cotton gauze or thin metal foil are applied to the finger after moistening with a salt solution or an electrically conducting paste or jelly, care being taken that the gauze or foil does not constrict the finger or impede the circulation. One of these electrodes is placed near the tip and the other near the base of the finger. Through these strips the finger is then connected to an alternating current bridge. This bridge, instead of having the customary earphones, is connected to an ampli-

[5] Krumbhaar, E. B., *J. Lab. and Clin. Med.*, 1922, **8**, 11.

[6] Mayerson, H. S., *Anat. Rec.*, 1930, **47**, 239.

[7] Scarborough, R., *Yale J. Biol. and Med.*, 1930, **3**, 359.